First Look
Outline

- **Purpose / Subtasks**

- **Input**

- **Output**

- **Approaches, Algorithms**

- **Relationships with Other Components**

- **Potential Problem Areas**

Purpose / Subtasks

- **Verify telemetry format**
- **Archive telemetry data**
- **Check engineering data — double-check on MOC**
  - Out-of-bounds conditions → anomaly report
  - Trend analysis
    - glitches, short-term changes, long-term trends
- **Establish correspondence between S/C clock and TAI**
  - $t_{S/C} = TAI_0 + r\,(TAI{-}TAI_0) + \dots$ $r \sim 10^{-10}$
- **Assemble CCD row data for each star (and identify star?)**
- **Check that observations are acceptable for pipeline processing**
  - (~pixel-level accuracy, ~0.2 arcsec)
  - Model-independent analyses
  - Model-dependent analyses

Input

- **All data from S/C downlink telemetry**
  - Engineering data
    - S/C clock time
    - Attitude & attitude rate, TDI rate
    - Temperature, power, status flags, etc.
  - Science data
    - Channel (CCD half), column & row identifiers
    - Binned or unbinned rows from postage stamps (some assembly required!)
    - Gain settings
- **Data from NRL orbit determination system**
    - Orbit parameters or series of S/C position & velocity vectors
- **Parameters from data analysis pipeline database**
  - PSF models
  - Star magnitudes & colors
  - Star pathology (multiplicity, variability)

MO&DA Review: First Look

Output

Parameters displayed as a function of time
Most will be sorted by CCD channel, star magnitude bin, & star color bin

- **Model-independent Analyses**
    - Total number of stars observed*
    - Total counts (sum over all pixel values)*
    - Image centroid wrt window center in 2D for grid stars
    - Same in 1D for program stars
    - Image width and asymmetry measures in 2D for grid stars
    - Same in 1D for program stars
    - Goodness-of-fit measure for image profiles

- Spin rate and spin axis direction
- Spin rate vs. TDI rate
- Engineering data (temperature, power, etc.)

- **Model-dependent Analyses**
    - Transit time O–Cs   (also, sorted by individual star)
    - Image width O–Cs
    - Total counts per observation O–Cs   (also, sorted by individual star)
    - Attitude from science data vs. attitude from ACS

* Σ over wide moving time window

Approaches, Algorithms

- **Parameters of interest generally analyzed as a time series** `Ex`
- **Also (via FFT) as a spectrum**
- **Recognize discontinuities and threshold values → anomaly reports**
- **Significant portion of analyses based on near-real-time determinations of image centers and widths**
  - Centroiding algorithm TBD— same as for pipeline?
- **Needs to develop simple model of S/C rotation**
  - Develop from Kalman filtering of ACS data?
- **"Fast Algorithm" used for time and column O-Cs**
- **"Factor analysis" on parameter correlation matrix**
  - Quantifies linkages (common factors) among multiple parameters

<u>Example</u>: For specific channel, magnitude range, color range:
cross-scan image width (smeared) as a function of time

cross-scan width

one
rotation

t

FF
T

ν
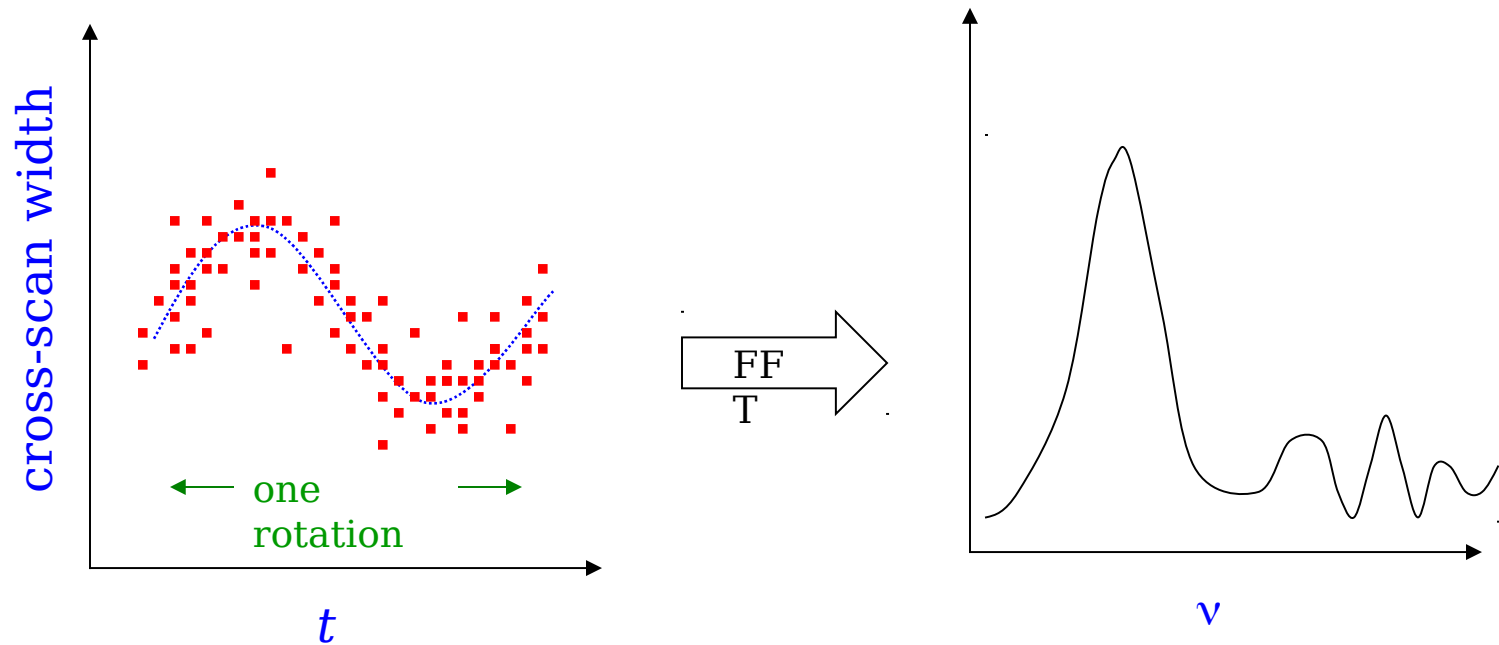
Ret

Relationships

First Look not really part of data analysis pipeline per se
However…

- **It is required to assemble observations for use by pipeline**
- **It is required to establish S/C clock relation to TAI**
- **It relies on data analysis database to develop expected values of counts for each observation (for unfiltered and filtered CCDs)**

  Essentially, retrieves magnitude and color from database for each star

- **It might be used to provide preliminary information for each observation ahead of pipeline processing**

  Total count, image height & width, possible pathology, etc.

  or… should DA centroiding be done here?

Potential Problem Areas

- **Speed of access to data analysis database**
- **How to incorporate flat-field data**
- **Criteria for recognition of stellar pathologies**
- **Recognition of long-term trends**
- **Recognition of column-by-column problems**
- **Can basic angle be recovered at this stage?**
- **Procedures for recovery from unusable data conditions**